ABSTRACT

In this study, the impact of hydrogen ion implantation on the structural and electrochemical properties of iron is investigated. The implanted ionic dose on the iron surface is kept constant i.e. 2.0×10^{14} ions/cm^2, but the total ion dose is distributed in the iron matrix in a novel way by changing the energy of incoming ions. H ion layers are formed within different depths of target lattice. The ion energy is varied step by step i.e. 300, 350, 400, and 450 KeV, with the help of the Pelletron accelerator. Various techniques are used for the analysis of post implanted iron samples i.e. XRD, SEM, and electrochemical testing. For the structural analysis of the samples, an x-ray diffraction technique is used. The XRD results revealed the variation in crystal growth, the layer formation encouraged the crystal growth along the (110) direction at the cost of crystal growth along (200) direction. The crystallite size of untreated and treated samples are calculated by using the Debye Scherrer formula. Results demonstrate that the crystallite size decreases as the implanted energy increases. To analyze the corrosion behavior of samples the electrochemical testing is performed. Corrosion studies revealed dramatic outputs the open circuit potential shifted to stable side in the two-layer sample then further stability is observed in the three-layer sample but the stability found to decrease in four-layer sample approximately equal to untreated sample. The surface morphology of iron samples, untreated, and treated has been examined by using a scanning electron microscope (SEM). The SEM study is performed after electrochemical testing of the samples to estimate the impact of corrosion in different samples. A sponge-like morphology is observed in the untreated sample, whereas in treated, samples the craters and dimples of different shapes and densities are observed, which indicated the pitting corrosion.